

Student Name _____

Teacher Name _____

School _____

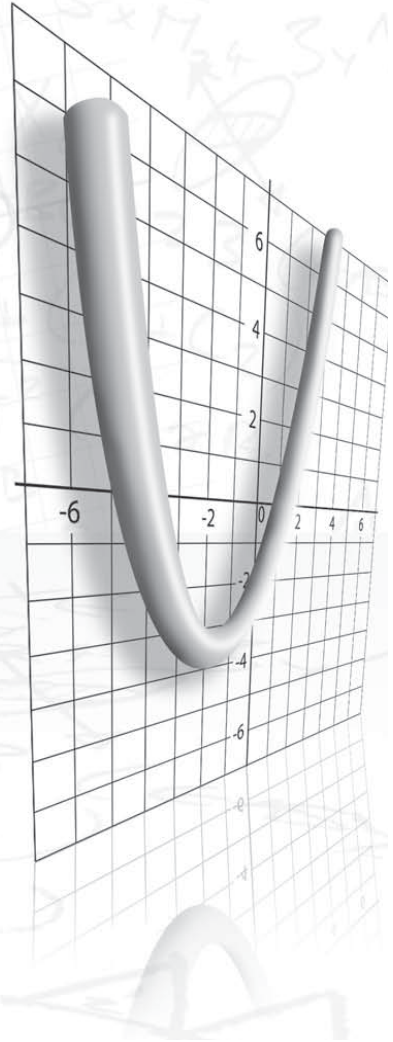
System _____

ALGEBRA II

Item Sampler

**Tennessee End of Course Assessment
Algebra II Form 3**

Reporting Category 3: Algebra

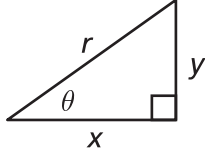


The Pearson logo consists of the word "PEARSON" in a bold, white, sans-serif font, centered within a solid black rectangular background.

PEARSON

Developed and published under contract with State of Tennessee Department of Education by the Educational Measurement group of Pearson, a business of NCS Pearson, Inc., 2510 North Dodge Street, Iowa City, Iowa 52245. Copyright © 2012 by State of Tennessee Department of Education. All rights reserved. No part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of State of Tennessee Department of Education.

Algebra II Reference Page

Trigonometric Functions	
$\sin \theta = \frac{y}{r}, \quad \csc \theta = \frac{r}{y}$ $\cos \theta = \frac{x}{r}, \quad \sec \theta = \frac{r}{x}$ $\tan \theta = \frac{y}{x}, \quad \cot \theta = \frac{x}{y}$	 $r = \sqrt{x^2 + y^2}$

Logarithm Properties
$\log_b MN = \log_b M + \log_b N$ $\log_b \left(\frac{M}{N} \right) = \log_b M - \log_b N$ $\log_b M^p = p \log_b M$ $\log_b x = y \Leftrightarrow x = b^y$

Arithmetic and Geometric Sequences and Series	
$a_1 = 1^{\text{st}} \text{ term}$ $r = \text{common ratio}$ $d = \text{common difference}$ $a_n = n^{\text{th}} \text{ term}$ $n = \text{number of terms in series}$	
Arithmetic Sequence: $a_n = a_1 + (n-1)d$	Geometric Sequence: $a_n = a_1 r^{n-1}$
Sum of a Finite Arithmetic Series:	$S_n = \frac{n(a_1 + a_n)}{2}$ or $S_n = \frac{1}{2}n[2a_1 + (n-1)d]$
Sum of a Finite Geometric Series:	$S_n = \frac{a_1(1-r^n)}{1-r}, \quad r \neq 1$
Sum of an Infinite Geometric Series:	$S = \frac{a_1}{1-r}$ where $ r < 1$

Combinations
${}_nC_r = \frac{n!}{r!(n-r)!}$

Permutations
${}_nP_r = \frac{n!}{(n-r)!}$

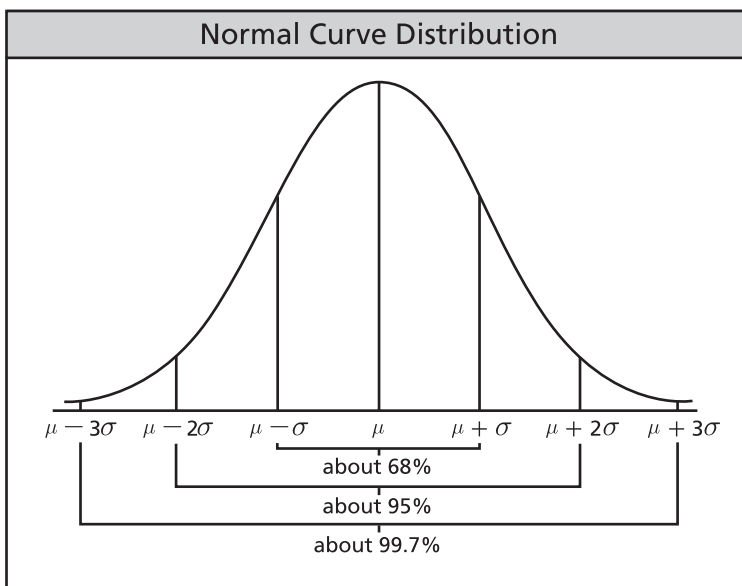
Binomial Theorem
$(a+b)^n = \sum_{r=0}^n \binom{n}{r} a^{n-r} b^r$

Quadratic Formula
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $y = ax^2 + bx + c$

Interest Formulas	
Compound interest: $A = P \left(1 + \frac{r}{n} \right)^{nt}$	$P = \text{present value}$
Continuous compound interest: $A = Pe^{rt}$	$A = \text{future value}$
	$r = \text{annual interest rate}$
	$t = \text{time in years}$
	$n = \text{frequency of compounding per year}$

Algebra II Reference Page

Conic Sections – Standard Equations			
Parabola	$y = a(x - h)^2 + k$	or	$x = a(y - k)^2 + h$
	$(y - k)^2 = 4p(x - h)$	or	$(x - h)^2 = 4p(y - k)$
Circle	$(x - h)^2 + (y - k)^2 = r^2$		
Ellipse	$\frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2} = 1$	or	$\frac{(x - h)^2}{b^2} + \frac{(y - k)^2}{a^2} = 1$
Hyperbola	$\frac{(x - h)^2}{a^2} - \frac{(y - k)^2}{b^2} = 1$	or	$\frac{(y - k)^2}{a^2} - \frac{(x - h)^2}{b^2} = 1$



Standard Deviation

The standard deviation, σ , for values $x_1, x_2, x_3, \dots, x_n$ with mean μ is determined by the following:

$$\sigma = \sqrt{\frac{(x_1 - \mu)^2 + (x_2 - \mu)^2 + \dots + (x_n - \mu)^2}{n}}$$

Probability Formulas

Exclusive
 $P(A \text{ or } B) = P(A) + P(B)$

Inclusive
 $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

Independent
 $P(A \text{ and } B) = P(A) \cdot P(B)$

Dependent
 $P(A \text{ and } B) = P(A) \cdot P(B|A)$

Conditional
 $P(B|A) = \frac{P(A \text{ and } B)}{P(A)}$

Algebra II Reference Page

Cramer's Rule for Solving a System of Linear Equations

For a 2×2 System:

$$\begin{array}{l} a_1x + b_1y = c_1 \\ a_2x + b_2y = c_2 \end{array} \quad x = \frac{\begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}} \quad y = \frac{\begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}}$$

For a 3×3 System:

$$\begin{array}{l} a_1x + b_1y + c_1z = d_1 \\ a_2x + b_2y + c_2z = d_2 \\ a_3x + b_3y + c_3z = d_3 \end{array} \quad x = \frac{\begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}} \quad y = \frac{\begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}} \quad z = \frac{\begin{vmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}}$$

Converting Degrees to Radians

Multiply degree measure
by $\frac{\pi}{180^\circ}$

Converting Radians to Degrees

Multiply radian measure
by $\frac{180^\circ}{\pi}$

Definition of "i"

$$\begin{aligned} i^2 &= -1 \\ i &= \sqrt{-1} \end{aligned}$$

Absolute Value of a Complex Number

$$|a + bi| = \sqrt{a^2 + b^2}$$

Contents

Introduction to Algebra II	7
Content of tests	7
Test development	7
Test administration	7
Tips for Taking the Test.....	9
Preparing for the test.....	9
Before the test	9
During the test.....	9
Directions for Using the Item Sampler	10
Algebra II Item Sampler	11
Answer Key with Reporting Category and Performance Indicator.....	61

Introduction to Algebra II

Content of tests

The testing program titled the *Tennessee End of Course Assessment* was established to meet the Tennessee mandate for end of course assessments in Tennessee secondary schools. These tests measure the Tennessee State Performance Indicators. Subject areas covered by the end of course assessments include Mathematics, Language Arts, History, and Science.

Test development

For the *Tennessee End of Course Assessment*, a staff of writers – composed of both teachers and professional test developers experienced in each of the content areas – researched and wrote the items. Professional editors and content specialists carefully reviewed all items and test directions for content and accuracy. To provide a large pool of items for final test selection, the test developers created approximately twice as many items as were needed in the final editions of the tests.

After tryout tests were administered, student responses were analyzed. Professional content editors and researchers carefully reviewed items, their data, and test directions for content, suitability, and accuracy before including particular items and test directions in operational tests.

Test administration

Tennessee End of Course Assessments are given to students as they near the end of courses that are included in the program. Tests may be given midyear for block schedules or at the end of the school year.

You will have ample time to read and answer each of the questions. The Algebra II test has been designed to be administered in one session and is not timed. The first 15 minutes are set aside to complete identifying data on the answer sheet.

Calculator use is optional. Sharing calculators during testing is not permitted.

The following types of calculators/devices may **NOT** be used during the test:

- pocket organizers
- electronic writing pads or input devices
- Some examples of prohibited calculators are:
 - Casio models: CFX-9970G, Algebra FX 2.0
 - Hewlett-Packard models: HP-40G, HP-49G
 - Texas Instruments models: TI-89, TI-92, Voyage 200, TI-NSPIRE – the CAS version (The non-CAS version of TI-NSPIRE is allowable.)
- calculators that can communicate (transfer data or information) wirelessly with other student calculators/devices
- cell phones, PSPs, and/or iPods
- Students may use any four-function, scientific, or graphing calculator does not have any of the above features. The use of units that have a Computer Algebra System (CAS) is NOT allowed.

Tips for Taking the Test

Preparing for the test

- Review this Tennessee End of Course Item Sampler for Algebra II carefully and thoroughly.
- Acquire the Tennessee End of Course Practice Test for Algebra II, and take the test several times.
- Become familiar with the correct way to mark answers on the answer sheet.

Before the test

- Get a good night's sleep. To do your best, you need to be rested.

During the test

- Relax. It is normal to be somewhat nervous before the test. Try to relax and not worry.
- Listen. Listen to and read the test directions carefully. Ask for an explanation of the directions if you do not understand them.
- Plan your time. Do not spend too much time on any one question. If a question seems to take too long, skip it and return to it later. First answer all questions that you are sure about.
- Think. If you are not sure how to answer a question, read it again and try your best to answer the question. Rule out answer choices that you know are incorrect and choose from those that remain.

Directions for Using the Item Sampler

This Item Sampler for Algebra II provides specific information to students and teachers. It contains examples of different item types for each Performance Indicator that may be tested in any given end of course test administration. Performance Indicators have been grouped by Reporting Categories. These Reporting Categories will be used to report information regarding performance on the end of course test to students, teachers, schools, and systems.

The items in this Item Sampler will not be found in the end of course tests. The number of items in this Item Sampler does not reflect the emphasis of content on the test. In order to identify the emphasis of content, the End of Course Assessment Practice Test for Algebra I should be used. The Practice Test gives a better representation of content emphasis across Reporting Categories and Performance Indicators.

An Answer Key is located in Page 61. Use it to check your answers. Review items that you get wrong.

Reporting Category: Algebra
Numbers 1 through 95

Performance Indicator: 3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.

1.

What is the sum of $4p^3 + 3p^2 - 15$ and $12p^3 - 4p + 23$?

- ☐ A $16p^3 - p^2 + 8$
- ☐ B $16p^3 + p^2 + 8$
- ☐ C $16p^3 + 3p^2 - 4p - 8$
- ☐ D $16p^3 + 3p^2 - 4p + 8$

Performance Indicator: 3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.

2.

Find the area of a rectangle with side lengths of $(2r - 9)$ and $(3r - 4)$.

- ☐ A $6r^2 - 35r + 36$
- ☐ B $6r^2 + 35r - 36$
- ☐ C $6r^2 - 30r + 36$
- ☐ D $6r^2 + 35r + 36$

Performance Indicator: 3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.

3.

What is the solution set for $(x - 2)^2 = 64$?

- ☐ A $\{-6\}$
- ☐ B $\{10\}$
- ☐ C $\{-6, 10\}$
- ☐ D $\{6, -10\}$

Performance Indicator: 3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.

4.

Which ordered pair, (x, y) , represents the solution to this system of equations?

$$y = (x + 3)^2$$
$$y = x^2 + 9$$

- ☐ A $(0, 3)$
- ☐ B $(0, 9)$
- ☐ C $(9, 0)$
- ☐ D $(3, 0)$

Performance Indicator: 3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.

5.

What are the roots of the equation $x^4 + 2x^3 - 17x^2 - 18x + 72 = 0$?

- ☐ A -2, -3, 2, and 4
- ☐ B -3, -4, 2, and 3
- ☐ C -2, -3, -4, and 3
- ☐ D -3, 2, 3, and 4

Performance Indicator: 3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.

6.

What are the roots of the equation below?

$$x^4 - 6x^2 + 8 = 0$$

- ☐ A $2, \sqrt{2}$, and $-\sqrt{2}$
- ☐ B $-2, 2$, and $\sqrt{2}$
- ☐ C $-2, 2, \sqrt{2}$, and $-\sqrt{2}$
- ☐ D $-2, 2$, and $-\sqrt{2}$

Performance Indicator: 3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.

7.

What is the sum of $\frac{9}{2a^{\frac{3}{2}}}$ and $\frac{2a^{\frac{1}{2}}}{4}$?

- ☐ A $\frac{18+a^{\frac{2}{3}}}{2a^{\frac{3}{2}}}$
- ☐ B $\frac{9+a^{\frac{3}{4}}}{2a^{\frac{3}{2}}}$
- ☐ C $\frac{18+a^{\frac{3}{4}}}{2a^{\frac{3}{2}}}$
- ☐ D $\frac{9+a^{\frac{2}{3}}}{2a^{\frac{3}{2}}}$

Performance Indicator: 3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.

8.

Which expression is equivalent to $\frac{8x^{-1}+6}{2x^{\frac{3}{2}}}$, for all $x \neq 0$?

- ☐ A $\frac{2(2+3x)}{x^{\frac{3}{2}}}$
- ☐ B $\frac{2(2+3x)}{x^{\frac{5}{2}}}$
- ☐ C $\frac{(4+3x)}{x^{\frac{3}{2}}}$
- ☐ D $\frac{(4+3x)}{x^{\frac{5}{2}}}$

Performance Indicator: 3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.

9.

Which is a simplified form of the expression $\left(169s^{\frac{2}{3}}t^{\frac{4}{5}}\right)^{\frac{1}{2}} \cdot \left(64s^{\frac{8}{3}}t^2\right)^{\frac{1}{2}}$, for all $s, t \neq 0$?

- ☐ A $104s^{-1}t^{-\frac{3}{5}}$
- ☐ B $104s^{\frac{5}{3}}t^{\frac{7}{5}}$
- ☐ C $104s^{\frac{5}{3}}t^{\frac{12}{5}}$
- ☐ D $104s^{\frac{13}{3}}t^{\frac{19}{5}}$

Performance Indicator: 3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.

10.

What is the sum of the geometric series $\frac{25}{12} - \frac{5}{3} + \frac{4}{3} - \frac{16}{15} + \frac{64}{75} - \frac{256}{375}$ to the nearest thousandth?

- ☐ A 0.854
- ☐ B 1.157
- ☐ C 1.537
- ☐ D 7.686

Performance Indicator: 3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.

11.

What is the sum of the following infinite geometric series?

$$5.5 - 2.75 + 1.375 - 0.6875 + \dots$$

- ☐ A $\frac{3}{11}$
- ☐ B $\frac{6}{11}$
- ☐ C $\frac{11}{6}$
- ☐ D $\frac{11}{3}$

Performance Indicator: 3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.

12.

What is the range of $f(x) = 4x^2 - 12x + 27$?

- ☐ A $\{y \mid y \geq 36\}$
- ☐ B $\{y \mid y \geq 27\}$
- ☐ C $\{y \mid y \geq 18\}$
- ☐ D $\{y \mid y \geq 1.5\}$

Performance Indicator: 3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.

13.

The area of a rectangular field enclosed with 320 feet of fence is given as a function of its length, as $A(l) = 160l - l^2$. What is the domain of this function?

- ☐ A $l > 0$
- ☐ B $0 < l < 80$
- ☐ C $0 < l < 160$
- ☐ D $0 < l < 6,400$

Performance Indicator: 3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.

14.

What is the domain of $y = 9 - \sqrt{x - 5}$?

- ☐ A $\{x \mid x \geq 5\}$
- ☐ B $\{x \mid x \leq 5\}$
- ☐ C $\{x \mid x \geq 9\}$
- ☐ D $\{x \mid x \leq 9\}$

Performance Indicator: 3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.

15.

If $f(x) = 3x^3 - 4x^2 + 3$ and $g(x) = x^3 + 3x^2 - x - 4$, which expression represents $(f - g)(x)$?

- ☐ A $-2x^3 + 7x^2 - x - 7$
- ☐ B $2x^3 - x^2 - x - 1$
- ☐ C $2x^3 - 7x^2 + x + 7$
- ☐ D $-2x^3 - x^2 - x - 1$

Performance Indicator: 3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.

16.

If $f(x) = -x^2 - 2$ and $g(x) = 3x - 4$, which expression represents $f(g(x))$?

- ☐ A $-3x^3 + 4x^2 - 6x + 8$
- ☐ B $-9x^2 + 24x - 18$
- ☐ C $-9x^2 - 18$
- ☐ D $-3x^2 - 10$

Performance Indicator: 3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.

17.

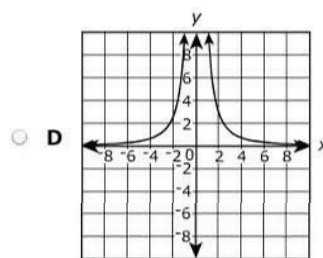
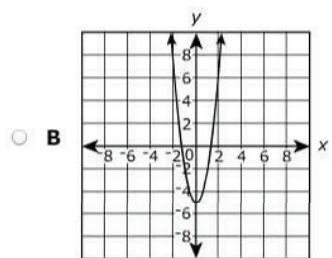
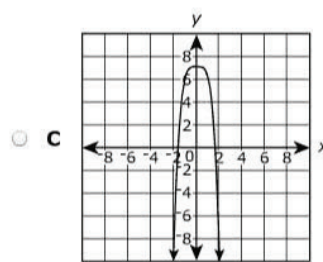
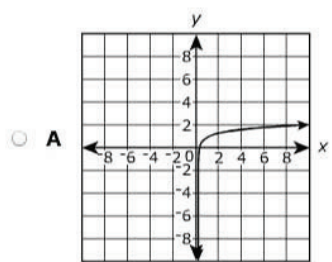
Let $f(x) = \frac{x^2+2}{5}$ and $g(x) = 3x$. Which expression represents $f(g(x))$?

- ☐ A $\frac{3x^2+2}{5}$
- ☐ B $\frac{3x^2+6}{5}$
- ☐ C $\frac{9x^2+2}{5}$
- ☐ D $\frac{3x^3+6x}{5}$

Performance Indicator: 3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.

18.

Which function has an inverse that is also a function?



Performance Indicator: 3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.

19.

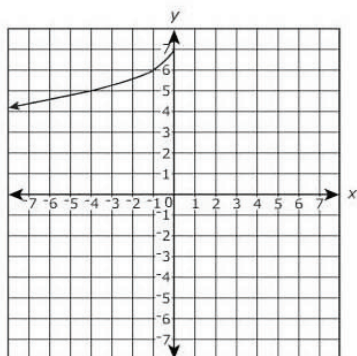
The graph of the inverse of a function is its reflection over the line $y = x$. Which of these statements does not support this definition of the inverse of a function?

- ☐ **A** For every ordered pair (x, y) satisfying a function, there will be an ordered pair (y, x) satisfying its inverse.
- ☐ **B** The domain and range of a function respectively are the range and domain of the inverse of that function.
- ☐ **C** The function and its inverse are multiplicative inverses of each other.
- ☐ **D** For any function $f(x)$ and its inverse $f^{-1}(x)$, $f(f^{-1}(x)) = x$.

Performance Indicator: 3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.

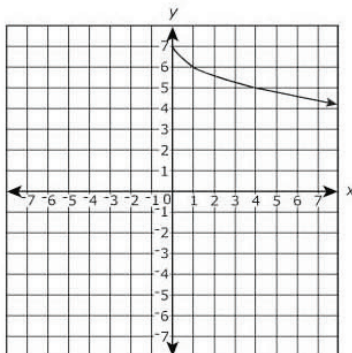
20.

Consider the following graph.

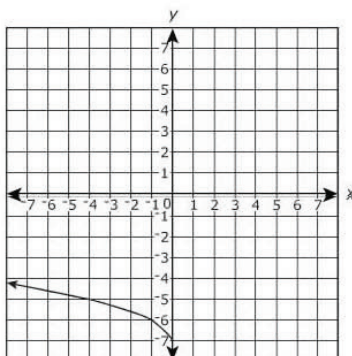


Which graph **best** represents the inverse of the function represented by the graph above?

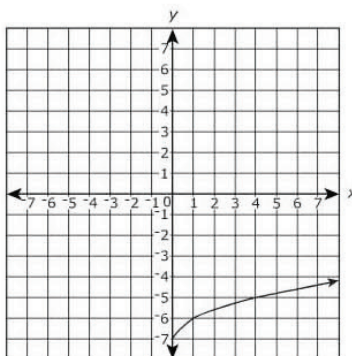
☐ A



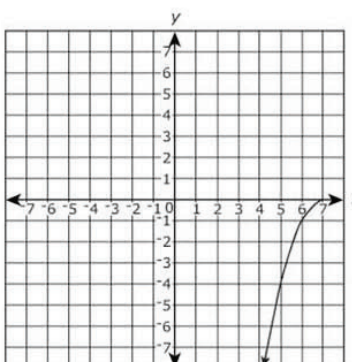
☐ B



☐ C



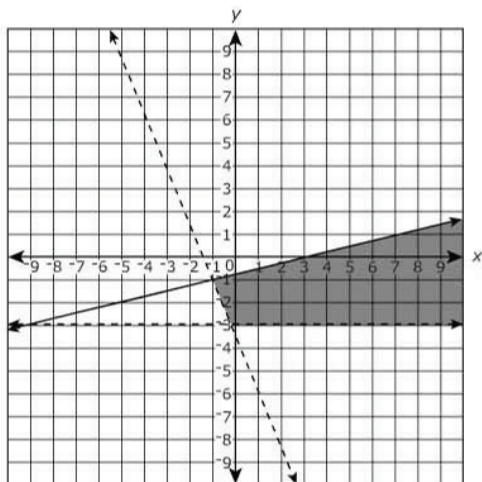
☐ D



Performance Indicator: 3103.3.9 Graph the solution set of two or three linear or quadratic inequalities.

21.

Which system of inequalities is best represented by the shaded region below?



☐ A $\begin{cases} x - 4y \geq 3 \\ 5x + 2y \geq -7 \\ y \geq -3 \end{cases}$

☐ B $\begin{cases} x - 4y > 3 \\ 5x + 2y \geq -7 \\ y \geq -3 \end{cases}$

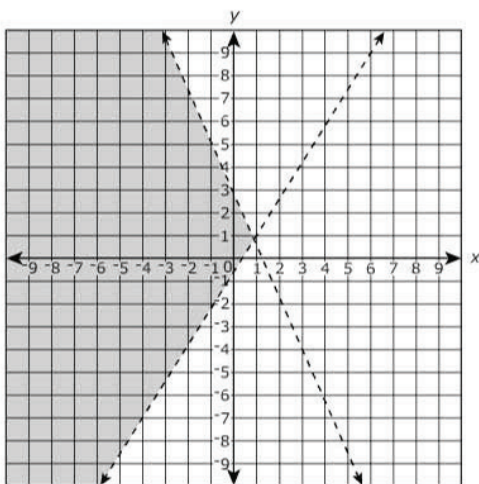
☐ C $\begin{cases} x - 4y \geq 3 \\ 5x + 2y > -7 \\ y > -3 \end{cases}$

☐ D $\begin{cases} x - 4y \leq 3 \\ 5x + 2y > -7 \\ y > -3 \end{cases}$

Performance Indicator: 3103.3.9 Graph the solution set of two or three linear or quadratic inequalities.

22.

Which system of inequalities is represented by the graph shown below?



☐ A $\begin{cases} 7x + 3y > 9 \\ 8x - 5y > 3 \end{cases}$

☐ B $\begin{cases} 7x + 3y < 9 \\ 8x - 5y > 3 \end{cases}$

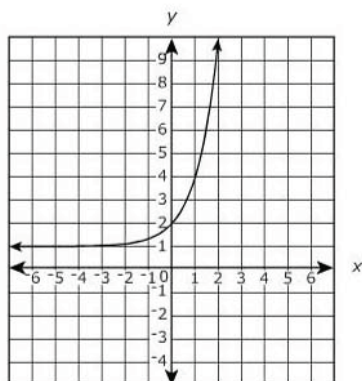
☐ C $\begin{cases} 7x + 3y < 9 \\ 8x - 5y < 3 \end{cases}$

☐ D $\begin{cases} 7x + 3y > 9 \\ 8x - 5y < 3 \end{cases}$

Performance Indicator: 3103.3.10 Identify and/or graph a variety of functions and their transformations.

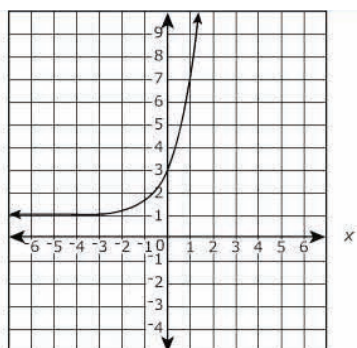
23.

The graph of $f(x) = 3^x + 1$ is shown below.

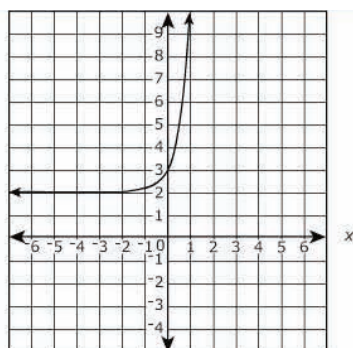


Which graph best represents the function $f(2x)$?

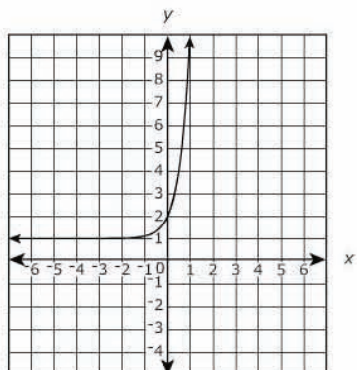
☐ A



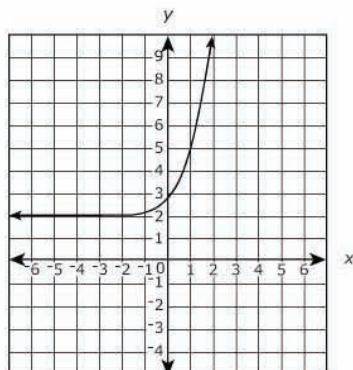
☐ C



☐ B



☐ D



Performance Indicator: 3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.

24.

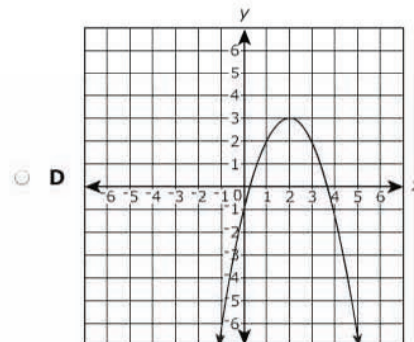
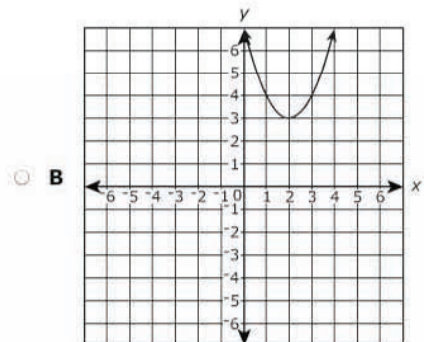
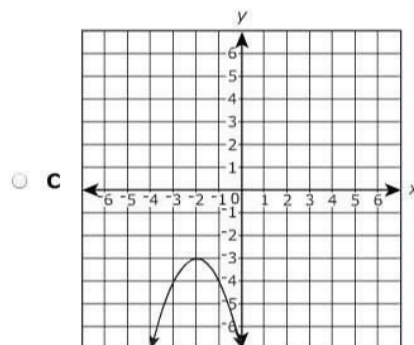
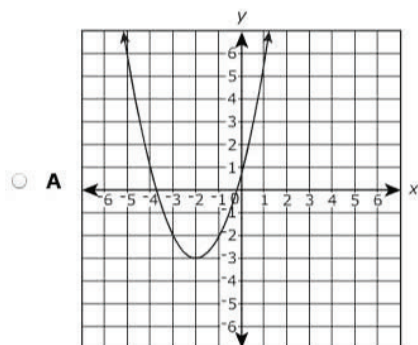
Which equation can be used to graph a circle with a radius of 5 and the center at $(-3, 6)$?

- ☐ A $(x + 3)^2 + (y - 6)^2 = 5$
- ☐ B $(x + 3)^2 + (y - 6)^2 = 25$
- ☐ C $(x - 3)^2 + (y + 6)^2 = 5$
- ☐ D $(x - 3)^2 + (y + 6)^2 = 25$

Performance Indicator: 3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.

25.

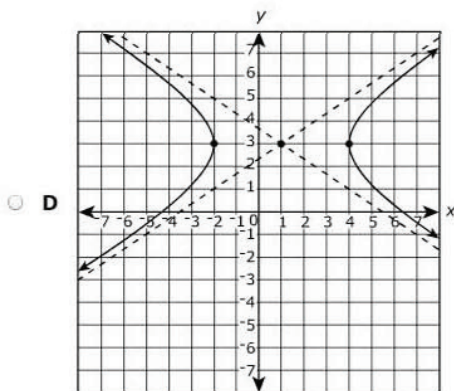
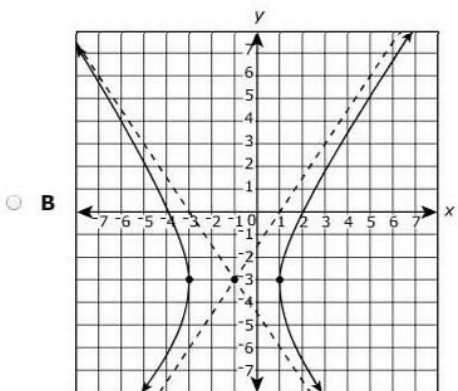
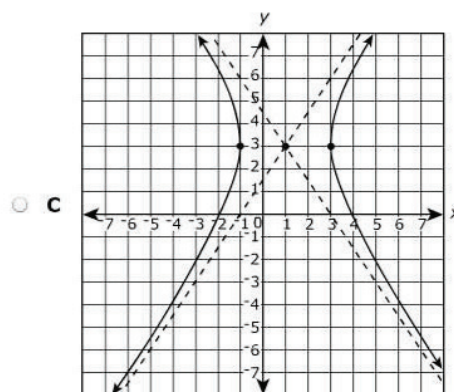
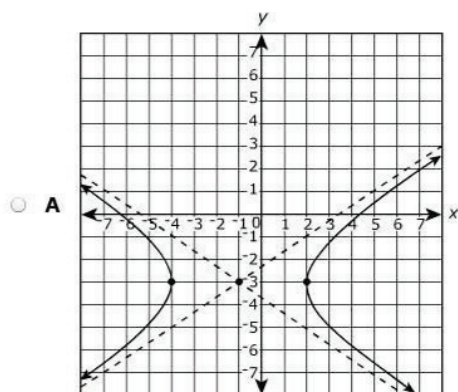
Which graph **best** represents $y = (x + 2)^2 - 3$?



Performance Indicator: 3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.

26.

Which graph best represents the equation $\frac{(x+1)^2}{9} - \frac{(y+3)^2}{4} = 1$?

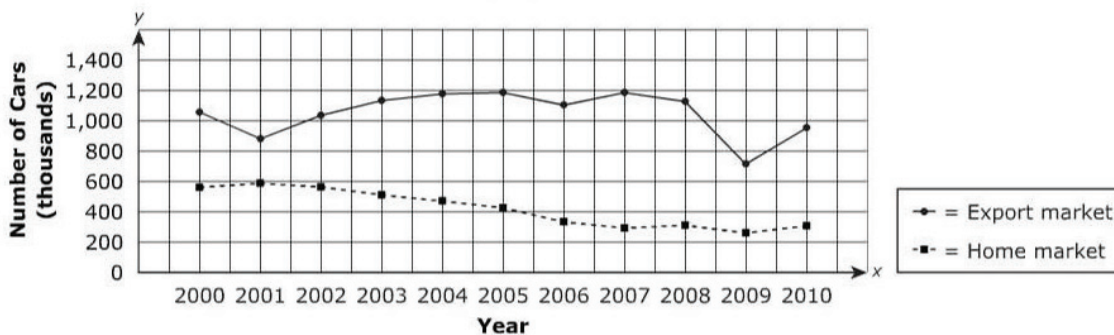


Performance Indicator: 3103.3.12 Interpret graphs that depict real-world phenomena.

27.

The graph below shows car sales over a period of time.

Car Sales



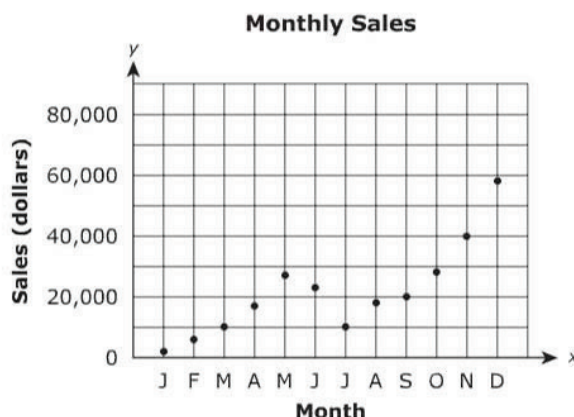
The total number of cars sold every year is the sum of the number of cars sold in both the export and the home markets. In which year was the maximum total number of cars sold?

- ☐ A 2001
- ☐ B 2003
- ☐ C 2007
- ☐ D 2009

Performance Indicator: 3103.3.12 Interpret graphs that depict real-world phenomena.

28.

The graph below shows the monthly sales of an electronics business from last year.



Which statement is **best** supported by the data in the graph?

- ☐ A The median sales over the year equal \$57,000.
- ☐ B The lowest sales of the year occur in July.
- ☐ C The sales in March are about twice the sales in November.
- ☐ D The sales in July are about half the sales in September.

Performance Indicator: 3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.

29.

Raleigh dropped a ball from the top of a 60-foot-tall building. The distance, d , of the ball from the ground after t seconds is modeled by the equation $d(t) = -16t^2 + 28t + 60$. How long did it take for the ball to hit the ground?

- ☐ A 3 seconds
- ☐ B 6 seconds
- ☐ C 9 seconds
- ☐ D 20 seconds

Performance Indicator: 3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.

30.

The population of a certain species of deer in a habitat is modeled by the equation $P = 2,725e^{0.26t}$, where t is the number of years counted from the present year. Which is closest to the number of years it will take for the population to increase by 7,275?

- ☐ A 2 years
- ☐ B 3 years
- ☐ C 4 years
- ☐ D 5 years

Performance Indicator: 3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.

31.

The sum of the ages of Steve and his younger brother, Roger, is 18 years. If three times Roger's age is subtracted from two times Steve's age, the difference is 6. How old is Roger?

- ☐ A 6 years old
- ☐ B 8 years old
- ☐ C 10 years old
- ☐ D 12 years old

Performance Indicator: 3103.3.14 Solve problems involving the binomial theorem and its connection to Pascal's Triangle, combinatorics, and probability.

32.

A newspaper reported that 65% of the total population in a city used cars to commute in a single day. What is the probability that in a group of 20 people from the city, exactly 18 people will use cars to commute on a particular day?

- ☐ A $153(0.65)^2(0.35)^{18}$
- ☐ B $153(0.65)^{18}(0.35)^2$
- ☐ C $190(0.65)^2(0.35)^{18}$
- ☐ D $190(0.65)^{18}(0.35)^2$

Performance Indicator: 3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.

33.

What is the product of $(11x + 5)$ and $(4x - 7)$?

- ☐ A $44x^2 - 57x - 35$
- ☐ B $44x^2 + 97x + 35$
- ☐ C $44x^2 + 27x - 35$
- ☐ D $44x^2 + 57x - 35$

Performance Indicator: 3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.

34.

If $r \neq -\frac{9}{2}$, which expression is equivalent to $\frac{14r^4 + 47r^3 - 66r^2 + 23r - 18}{2r + 9}$?

- ☐ A $7r^3 - 8r^2 + 3r - 2$
- ☐ B $7r^3 + 8r^2 + 3r + 2$
- ☐ C $7r^3 + 8r^2 + 3r - 2$
- ☐ D $7r^3 - 8r^2 + 3r + 2$

Performance Indicator: 3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.

35.

What is the solution set for the equation $3x^2 - 15x = 42$?

- ☐ A $\{-21, 6\}$
- ☐ B $\{-6, 21\}$
- ☐ C $\{-7, 2\}$
- ☐ D $\{-2, 7\}$

Performance Indicator: 3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.

36.

The entrance fee for a museum is \$12.00 for students, \$15.00 for senior citizens, and \$20.00 for adults. One Monday 1,350 people visited the museum, and a total of \$20,750 was collected. If the total fee collected from people other than adults was \$9,750, how many students, senior citizens, and adults visited the museum that day?

- ☐ A 750 students, 550 senior citizens, and 50 adults
- ☐ B 750 students, 50 senior citizens, and 550 adults
- ☐ C 550 students, 50 senior citizens, and 750 adults
- ☐ D 550 students, 750 senior citizens, and 50 adults

Performance Indicator: 3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.

37.

What are the solutions to the following equation?

$$6x^3 - 17x^2 + 11x - 2 = 0$$

- ☐ A $x = -2, -\frac{1}{2}, \frac{1}{3}$
- ☐ B $x = 2, -\frac{1}{2}, -\frac{1}{3}$
- ☐ C $x = -2, -\frac{1}{2}, -\frac{1}{3}$
- ☐ D $x = 2, \frac{1}{2}, \frac{1}{3}$

Performance Indicator: 3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.

38.

Which is a simplified form of $\frac{x+y}{x^{-1}y^{-1}} - \frac{x^2+y^2}{x^{-1}+y^{-1}}$?

- ☐ A $\frac{2xy}{(x+y)}$
- ☐ B $\frac{2x^2y^2}{(x+y)}$
- ☐ C $2xy^2$
- ☐ D $\frac{2}{(x+y)}$

Performance Indicator: 3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.

39.

Simplify: $\left(\frac{\frac{1}{9}p^4q^{\frac{5}{2}}}{\frac{3}{10}p^4q^{\frac{2}{2}}} \right) \div \left(\frac{\frac{7}{6}q^{\frac{2}{2}}}{\frac{5}{p^4}} \right)$, for all $p, q \neq 0$

- ☐ A $\frac{3p^{\frac{3}{4}}}{20q^{\frac{11}{2}}}$
- ☐ B $\frac{27q^{\frac{3}{2}}}{5p^4}$
- ☐ C $\frac{3q^{\frac{7}{2}}}{20p^4}$
- ☐ D $\frac{27p^{\frac{9}{4}}}{5q^{\frac{21}{2}}}$

Performance Indicator: 3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.

40.

Which expression is equivalent to $\left(\frac{125p^2q^{\frac{5}{2}}}{216p^3q^{\frac{2}{3}}} \right)^{\frac{1}{3}}$, for all $p, q \neq 0$?

- ☐ A $\frac{5}{6}p^3q^{\frac{5}{3}}$
- ☐ B $\frac{5}{6}p^{\frac{4}{3}}q$
- ☐ C $\frac{5}{6}p^{\frac{4}{9}}q^{\frac{1}{3}}$
- ☐ D $\frac{5}{6}p^{\frac{8}{9}}q^{\frac{4}{3}}$

Performance Indicator: 3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.

41.

What is the sum of the arithmetic series shown below?

$$\sum_{n=4}^{15} \left(2n + \frac{1}{5} \right)$$

- ☐ A $230\frac{2}{5}$
- ☐ B $211\frac{1}{5}$
- ☐ C $181\frac{1}{5}$
- ☐ D $111\frac{3}{5}$

Performance Indicator: 3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.

42.

What is the sum of the infinite geometric series below?

$$3 - \frac{9}{4} + \frac{27}{16} - \frac{81}{64} + \dots$$

- ☐ A $\frac{9}{7}$
- ☐ B $\frac{12}{7}$
- ☐ C $\frac{21}{4}$
- ☐ D 12

Performance Indicator: 3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.

43.

What is the sum of the first 10 terms of the sequence below?

$$3, \frac{3}{2}, \frac{3}{4}, \dots$$

- ☐ A $\frac{1,025}{512}$
- ☐ B $\frac{3,069}{512}$
- ☐ C 1,025
- ☐ D 3,069

Performance Indicator: 3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.

44.

What is the range of the function below?

$$f(x) = \frac{\sqrt{100 - 25x^2}}{2}$$

- ☐ A $0 \leq y \leq 5$
- ☐ B $-2 \leq y \leq 2$
- ☐ C $y \leq 2$
- ☐ D $y \geq 0$

Performance Indicator: 3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.

45.

What is the domain and the range of the function $f(x) = |x + 1| - 2$?

- ☐ A domain: $\{x \mid x \geq -1\}$, range: $\{y \mid y \in \mathbb{R}\}$
- ☐ B domain: $\{x \mid x \geq -1\}$, range: $\{y \mid y \geq -2\}$
- ☐ C domain: $\{x \mid x \in \mathbb{R}\}$, range: $\{y \mid y \geq -2\}$
- ☐ D domain: $\{x \mid x \in \mathbb{R}\}$, range: $\{y \mid y \in \mathbb{R}\}$

Performance Indicator: 3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.

46.

Let $f(x) = \frac{x+2}{x^2-5x+6}$ and $g(x) = \frac{3}{2-x}$. Which expression represents $(f+g)(x)$, for

$x \neq 2, x \neq 3$?

- ☐ A $\frac{2x+11}{(x+3)(2-x)}$
- ☐ B $\frac{4x-7}{(x-2)(x-3)}$
- ☐ C $\frac{x-1}{(x-2)(x-3)}$
- ☐ D $\frac{-2x+11}{(x-2)(x-3)}$

Performance Indicator: 3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.

47.

If $f(x) = \frac{x^2-36}{-5x^2}$ and $g(x) = x-6$, which expression represents $\frac{f(x)}{g(x)}$ for all values in the domain?

- ☐ A $-\frac{x-6}{5x^2}$
- ☐ B $-\frac{x+6}{5x^2}$
- ☐ C $\frac{x-6}{5x^2}$
- ☐ D $\frac{x+6}{5x^2}$

Performance Indicator: 3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.

48.

Given $g(x) = \sqrt{x^2 + 4}$ and $h(x) = 2x - 1$, which expression represents $g(h(x))$?

- ☐ A $\sqrt{4x^2 - 4x + 5}$
- ☐ B $\sqrt{4x^2 - 4x + 3}$
- ☐ C $\sqrt{4x^2 + 3}$
- ☐ D $\sqrt{4x^2 + 5}$

Performance Indicator: 3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.

49.

What is the value of $g\left(f\left(-\frac{1}{2}\right)\right)$, for $f(x) = 4x^2 - 3x + 1$ and $g(x) = \frac{x-3}{4}$?

- ☐ A $\frac{7}{2}$
- ☐ B $\frac{1}{8}$
- ☐ C $-\frac{7}{8}$
- ☐ D $-\frac{49}{16}$

Performance Indicator: 3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.

50.

What is the inverse of the function $f(x) = 8x^{\frac{3}{4}} + 7$?

- ☐ A $f^{-1}(x) = \frac{1}{16}(x - 7)^{\frac{4}{3}}$
- ☐ B $f^{-1}(x) = \frac{1}{16}(x + 7)^{\frac{4}{3}}$
- ☐ C $f^{-1}(x) = \frac{1}{8}(x - 7)^{\frac{3}{4}}$
- ☐ D $f^{-1}(x) = \frac{1}{8}(x + 7)^{\frac{3}{4}}$

Performance Indicator: 3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.

51.

Which sets of functions are inverses of each other?

- ☐ A $f(x) = 8 - \frac{x}{5}$ and $g(x) = 8 + \frac{x}{5}$
- ☐ B $f(x) = \frac{7}{2-x^3}$ and $g(x) = \frac{2-x^3}{7}$
- ☐ C $f(x) = 7x^2 + 8$ and $g(x) = \sqrt{\frac{x-8}{7}}$
- ☐ D $f(x) = 3 - x^{\frac{2}{5}}$ and $g(x) = -(x - 3)^{\frac{2}{5}}$

Performance Indicator: 3103.3.8 Solve systems of three linear equations in three variables.

52.

A manager at a grocery store records the total sales of tomatoes, onions, and carrots for each of three days in the table below.

Sales of Vegetables

	Tomatoes (lbs)	Onions (lbs)	Carrots (lbs)	Total sales
Day 1	46	36	52	\$139
Day 2	38	28	44	\$115
Day 3	36	26	38	\$105

If the price per pound (lb) of each vegetable stays the same on all three days, what is the price per pound of tomatoes, onions, and carrots?

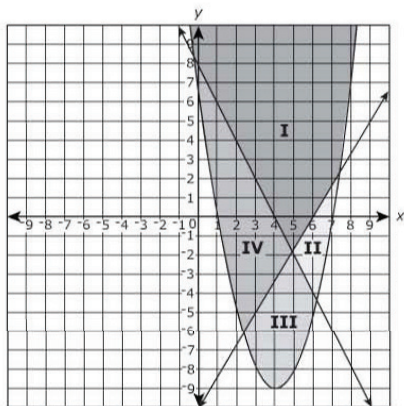
- ☐ A tomatoes = \$0.50/lb; onions = \$1.50/lb; carrots = \$1.00/lb
- ☐ B tomatoes = \$1.00/lb; onions = \$0.50/lb; carrots = \$1.50/lb
- ☐ C tomatoes = \$1.00/lb; onions = \$1.50/lb; carrots = \$0.50/lb
- ☐ D tomatoes = \$1.50/lb; onions = \$0.50/lb; carrots = \$1.00/lb

Performance Indicator: 3103.3.9 Graph the solution set of two or three linear or quadratic inequalities.

53.

Which region in the graph below best represents the solution set of the following system of inequalities?

$$\begin{aligned} 2x + y &\geq 8 \\ 5x - 3y &\geq 30 \\ y &\geq x^2 - 8x + 7 \end{aligned}$$



- ☐ A Region I
- ☐ B Region II
- ☐ C Region III
- ☐ D Region IV

Performance Indicator: 3103.3.10 Identify and/or graph a variety of functions and their transformations.

54.

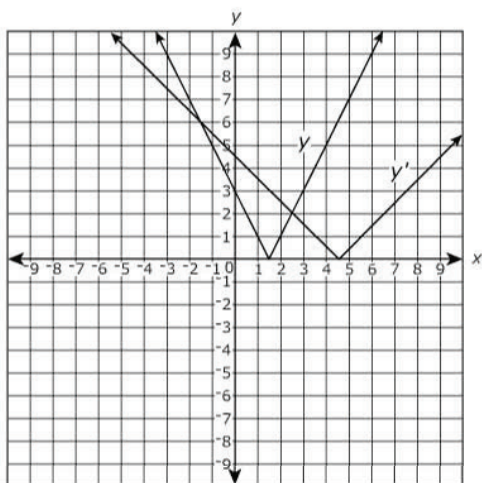
What is the effect on the graph of the equation $f(x) = x^2 + 2$ when the constant is changed to -6 ?

- ☐ A The graph shifts down by 6 units.
- ☐ B The graph shifts up by 6 units.
- ☐ C The graph shifts down by 8 units.
- ☐ D The graph shifts up by 8 units.

Performance Indicator: 3103.3.10 Identify and/or graph a variety of functions and their transformations.

55.

The graph of the equation $y = |2x - 3|$ is compressed vertically by a scale factor of $\frac{1}{2}$ and translated to the right 3 units to create y' .



Which equation best represents the graph of y' ?

- ☐ A $y' = 2|2x - 9|$
- ☐ B $y' = \frac{1}{2}|2x + 3|$
- ☐ C $y' = 2|2x + 3|$
- ☐ D $y' = \frac{1}{2}|2x - 9|$

Performance Indicator: 3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.

56.

A parabola has a vertex at $(-1, 2)$ and passes through the point $(1, -2)$. Which equation can be used to graph the parabola?

- ☐ A $y = -(x + 1)^2 + 2$
- ☐ B $y = (x - 1)^2 + 2$
- ☐ C $y = -(x - 2)^2 - 1$
- ☐ D $y = \frac{1}{8}(x - 2)^2 - 1$

Performance Indicator: 3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.

57.

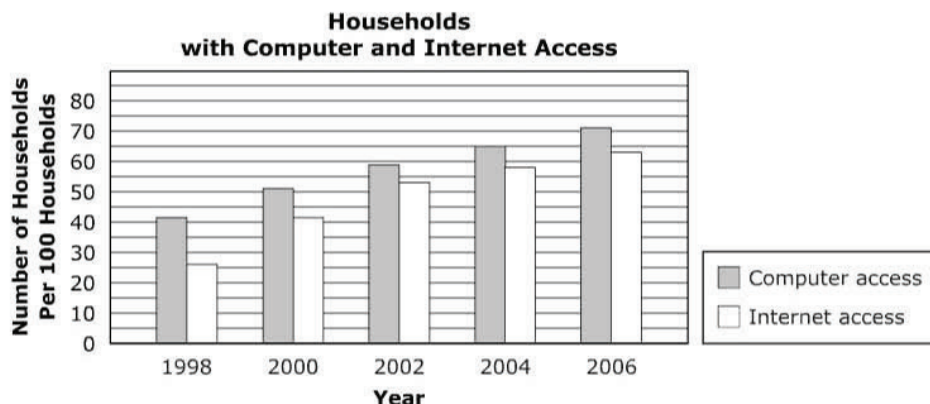
Which equation can be used to graph an ellipse with vertices of $(\pm 13, 0)$ and foci $(\pm 5, 0)$?

- ☐ A $\frac{x^2}{13} + \frac{y^2}{5} = 1$
- ☐ B $\frac{x^2}{13} + \frac{y^2}{12} = 1$
- ☐ C $\frac{x^2}{169} + \frac{y^2}{64} = 1$
- ☐ D $\frac{x^2}{169} + \frac{y^2}{144} = 1$

Performance Indicator: 3103.3.12 Interpret graphs that depict real-world phenomena.

58.

The double bar graph below compares households in the United States that had computer and Internet access from 1998 to 2006.



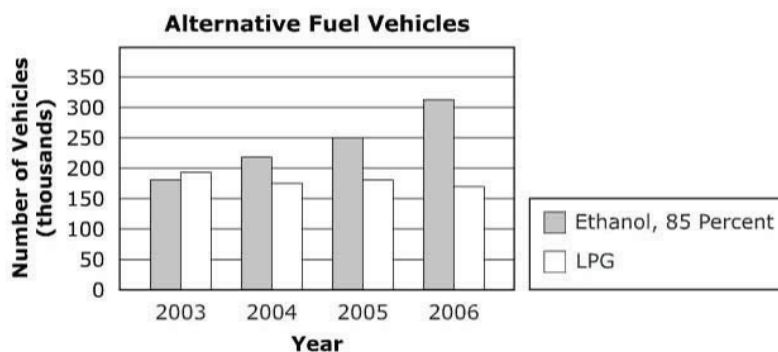
Which statement is **best** supported by the data in the graph?

- ☐ A The increase in households with Internet access is greatest from 1998 to 2000.
- ☐ B The increase in households with computer access is greatest from 2002 to 2004.
- ☐ C The increase in households with computer access is more than the increase in households with Internet access from 2000 to 2002.
- ☐ D The increase in households with Internet access is more than the increase in households with computer access from 2004 to 2006.

Performance Indicator: 3103.3.12 Interpret graphs that depict real-world phenomena.

59.

The graph below shows the number of two types of alternative-fuel vehicles in use from 2003 to 2006.



Which statement is **best** supported by the data in the graph?

- ☐ A The percent of increase of Ethanol-fueled vehicles is more than the percent of decrease of LPG-fueled vehicles from 2003 to 2006.
- ☐ B The percent of increase of Ethanol-fueled vehicles is less than the percent of decrease of LPG-fueled vehicles from 2003 to 2006.
- ☐ C The percent of increase of Ethanol-fueled vehicles is the greatest from 2003 to 2004.
- ☐ D The percent of decrease of LPG-fueled vehicles is greatest from 2004 to 2005.

Performance Indicator: 3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.

60.

The speed of a wave traveling through a string is represented by the formula $S = \sqrt{\frac{F \times L}{M}}$. The variables are defined below.

- S = speed of the wave in meters per second
- F = force on the string in Newtons
- L = length of the string in meters
- M = mass of the string in kilograms

A wave is traveling at a speed of 10 meters per second through a string with a mass of 0.2 kilogram stretched by a force of 19.6 Newtons. What is the length of the string to the nearest hundredth meter?

- ☐ A 0.10 meter
- ☐ B 1.01 meters
- ☐ C 1.02 meters
- ☐ D 5.10 meters

Performance Indicator: 3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.

61.

Gabel plans to construct a brick border of uniform width around his garden. The garden is 4 feet wide and 8 feet long. If the total area of the garden including the border is 45 ft^2 , what is the width of the brick border?

- ☐ A 0.5 foot
- ☐ B 1.0 feet
- ☐ C 3.6 feet
- ☐ D 6.5 feet

Performance Indicator: 3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.

62.

Kevin deposits a penny into a savings account on the first of the month. Each day he deposits double the amount he did the day before. How much will Kevin have in his account on the 15th of the month?

- ☐ A \$163.83
- ☐ B \$327.67
- ☐ C \$655.35
- ☐ D \$1,638.30

Performance Indicator: 3103.3.14 Solve problems involving the binomial theorem and its connection to Pascal's Triangle, combinatorics, and probability.

63.

What is the coefficient of the third term in the binomial expansion of $(4x - 3y)^5$?

- ☐ A 576
- ☐ B 640
- ☐ C 4,320
- ☐ D 5,760

Performance Indicator: 3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.

64.

Which expression gives the result $(-7t + 28)$ when subtracted from $(13t^2 - 5t - 9)$?

- ☐ A $13t^2 - 12t + 19$
- ☐ B $13t^2 + 2t - 37$
- ☐ C $-13t^2 - 2t + 37$
- ☐ D $-13t^2 + 12t - 19$

Performance Indicator: 3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.

65.

Which expression is equivalent to $\frac{12m^9n^9 - 30m^6n^6 + 42m^6n^3}{6m^3n^3}$, given $m \neq 0$ and $n \neq 0$?

- ☐ A $-2m^6n^6 + 5m^3n^3 - 7m^3$
- ☐ B $2m^3n^3 - 5m^2n^2 + 7m^2n$
- ☐ C $2m^6n^6 - 5m^3n^3 + 7m^3$
- ☐ D $2m^{12}n^{12} - 5m^9n^9 + 7m^9n^6$

Performance Indicator: 3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.

66.

What are the solutions for the following equation?

$$2x^2 - 4x = 30$$

- ☐ A $x = 3, 5$
- ☐ B $x = -3, 5$
- ☐ C $x = -5, 3$
- ☐ D $x = -3, -5$

Performance Indicator: 3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.

67.

Which ordered pair represents a solution to this system of equations?

$$\begin{cases} y = 2x^2 - 7x - 30 \\ y = 3x - 18 \end{cases}$$

- ☐ A $(0, 6)$
- ☐ B $(6, 0)$
- ☐ C $(1, -15)$
- ☐ D $(-6, -36)$

Performance Indicator: 3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.

68.

What are the roots of the equation $x^3 - 5x^2 + 8x - 4 = 0$?

- ☐ A 1 and 2
- ☐ B -1 and -2
- ☐ C -1, 1, and 2
- ☐ D -2, 1, and 2

Performance Indicator: 3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.

69.

Which is a simplified form of $\frac{5x-15y}{xy} + \frac{6y-2x}{2x^2y}$?

- ☐ A $\frac{3(x-3y)}{2x^2y}$
- ☐ B $\frac{4(x-3y)}{x^2y}$
- ☐ C $\frac{(x-3y)(5x-1)}{x^2y}$
- ☐ D $\frac{(x-3y)(5x-2)}{2x^2y}$

Performance Indicator: 3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.

70.

Which expression is equivalent to $\left(\frac{12a^{\frac{3}{4}}b^{\frac{2}{5}}}{20a^{\frac{1}{2}}} \right) \cdot \left(\frac{15}{b^{\frac{1}{5}}} \right)$, for all $a, b \neq 0$?

- ☐ A $3a^{\frac{1}{4}}b^{\frac{1}{5}}$
- ☐ B $9a^{\frac{1}{4}}b^{\frac{1}{5}}$
- ☐ C $3a^{\frac{5}{4}}b^{\frac{3}{5}}$
- ☐ D $9a^{\frac{5}{4}}b^{\frac{3}{5}}$

Performance Indicator: 3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.

71.

Which is a simplified form of the expression $\frac{3-7x^{-1}}{5+4x^{-2}}$, for all $x \neq 0$?

- ☐ A $\frac{x(3x-7)}{(5x^2+4)}$
- ☐ B $\frac{x(3-7x)}{(5+4x^2)}$
- ☐ C $\frac{(3x-7)}{x(5x^2+4)}$
- ☐ D $\frac{(3-7x)}{x(5+4x^2)}$

Performance Indicator: 3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.

72.

What is the 10th term of the sequence?

$$-\frac{1}{4}, -1, -\frac{7}{4}, -\frac{5}{2}, \dots$$

- ☐ A -14
- ☐ B $-\frac{23}{2}$
- ☐ C $-\frac{31}{4}$
- ☐ D -7

Performance Indicator: 3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.

73.

What is the sum of the geometric series $\sum_{i=0}^{10} [4(1.5)^i]$ to the nearest whole number?

- ☐ A 342
- ☐ B 453
- ☐ C 684
- ☐ D 690

Performance Indicator: 3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.

74.

What is the 12th term of the sequence below?

$$1, \frac{5}{6}, \frac{2}{3}, \frac{1}{2}, \dots$$

- ☐ A $\frac{19}{6}$
- ☐ B $\frac{17}{6}$
- ☐ C $-\frac{5}{6}$
- ☐ D $-\frac{7}{6}$

Performance Indicator: 3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.

75.

What is the domain of the function below?

$$f(x) = \frac{2x-3}{x^2-5}$$

- ☐ A all real numbers except $x = \sqrt{5}$
- ☐ B all real numbers except $x = -\sqrt{5}, \frac{3}{2}, \sqrt{5}$
- ☐ C all real numbers except $x = \frac{3}{2}, \sqrt{5}$
- ☐ D all real numbers except $x = -\sqrt{5}, \sqrt{5}$

Performance Indicator: 3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.

76.

The amount of algae, in pounds, that grows in a pond is given by the function $A(t) = 300e^{0.002t}$, where t represents days. What is the range of this function for $t \geq 0$?

- ☐ A $A(t) \geq 300$
- ☐ B $A(t) \geq 0$
- ☐ C $A(t) > 300$
- ☐ D $A(t) \geq 0.002$

Performance Indicator: 3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.

77.

What is the domain and the range of the function $f(x) = -\sqrt{2x - 6} + 2$?

- ☐ A domain: $\{x | x \geq -3\}$, range: $\{y | y \leq 2\}$
- ☐ B domain: $\{x | x \geq -3\}$, range: $\{y | y \geq 2\}$
- ☐ C domain: $\{x | x \geq 3\}$, range: $\{y | y \geq 2\}$
- ☐ D domain: $\{x | x \geq 3\}$, range: $\{y | y \leq 2\}$

Performance Indicator: 3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.

78.

Let $f(x) = \sqrt{x^2 + 3}$ and $g(x) = \sqrt{x^2 - 3}$. Which expression represents $f(x) \cdot g(x)$?

- ☐ A $\sqrt{x^4 + 9}$
- ☐ B $\sqrt{x^2 + 9}$
- ☐ C $\sqrt{x^4 - 9}$
- ☐ D $\sqrt{x^2 - 9}$

Performance Indicator: 3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.

79.

Given $g(x) = \frac{1}{2}x + 5$ and $h(x) = |-2x + 11|$, which expression represents $h(g(x))$?

- ☐ A $|-x - 10|$
- ☐ B $|-x + 1|$
- ☐ C $|-x + 10.5|$
- ☐ D $|-x + 16|$

Performance Indicator: 3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.

80.

If $f(x) = |-2x + 6|$ and $g(x) = \sqrt{x^2 + 9}$, what is the value of $f(g(4))$?

- ☐ A 10
- ☐ B 5
- ☐ C 4
- ☐ D 2

Performance Indicator: 3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.

81.

Which function does not have an inverse function?

- ☐ A $f(x) = 7 - \frac{1}{x}$
- ☐ B $f(x) = \frac{x^4}{16}$
- ☐ C $f(x) = 8 + \sqrt{-5x}$
- ☐ D $f(x) = e^{\frac{1}{x}}$

Performance Indicator: 3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.

82.

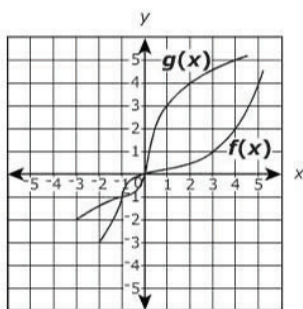
Which of these sets of functions are inverses of each other?

- ☐ A $f(x) = \sqrt{\frac{x-8}{2}}$ and $g(x) = 2x^2 + 8$
- ☐ B $f(x) = \sqrt[3]{x} + 8$ and $g(x) = \frac{1}{\sqrt[3]{x}} + 8$
- ☐ C $f(x) = \frac{7}{2}x - 3$ and $g(x) = -\frac{7}{2}x - 3$
- ☐ D $f(x) = \frac{1}{\sqrt{x-5}}$ and $g(x) = \sqrt{x} - 5$

Performance Indicator: 3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.

83.

Ricardo plots the graph of a function $f(x)$ and the graph of its inverse $g(x)$ as shown below.



Which of these statements proves that the two graphs are reflections of each other about the line $y = x$?

- ☐ A For every point (a, b) that lies on the graph of $f(x)$, the point (b, a) lies on the graph of its inverse $g(x)$.
- ☐ B For every point (a, b) that lies on the graph of $f(x)$, the point $(-a, -b)$ lies on the graph of its inverse $g(x)$.
- ☐ C For every point (a, b) that lies on the graph of $f(x)$, the point $(-b, -a)$ lies on the graph of its inverse $g(x)$.
- ☐ D For every point (a, b) that lies on the graph of $f(x)$, the point $(-a, b)$ lies on the graph of its inverse $g(x)$.

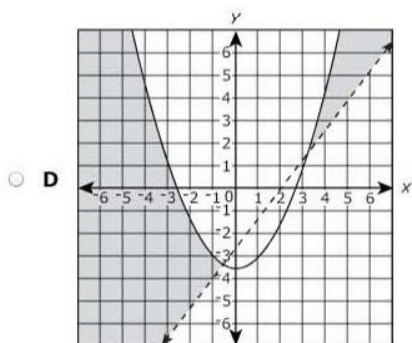
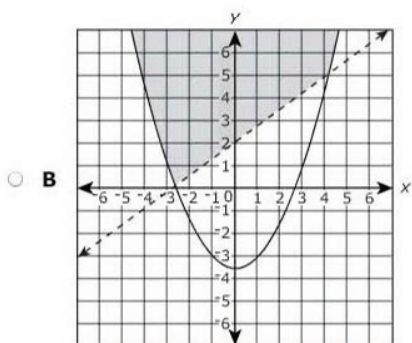
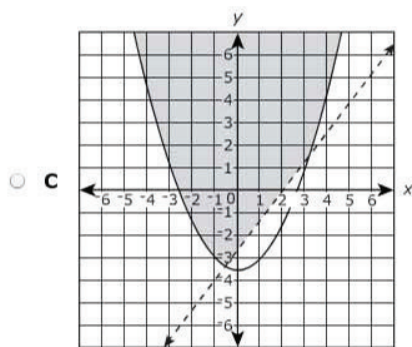
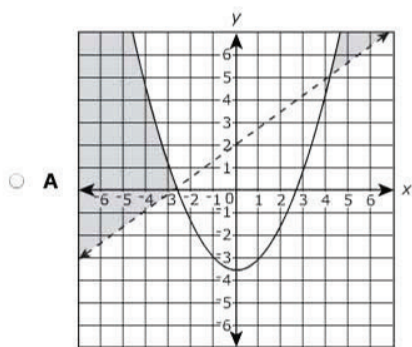
Performance Indicator: 3103.3.9 Graph the solution set of two or three linear or quadratic inequalities.

84.

Which graph best represents the system of inequalities below?

$$4y - 3x > 8$$

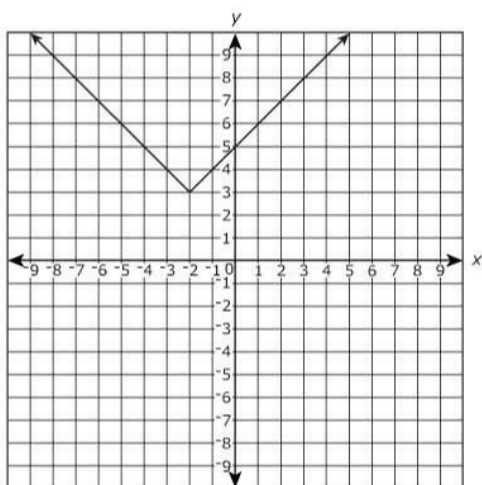
$$x^2 - 2y \leq 7$$



Performance Indicator: 3103.3.10 Identify and/or graph a variety of functions and their transformations.

85.

The graph of the equation $y = |x + 2| + 3$ shown below is translated left 2 units and then reflected over the x -axis.



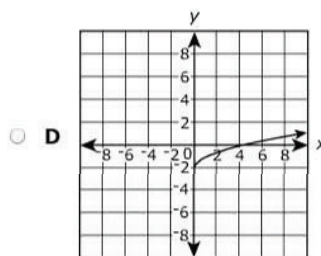
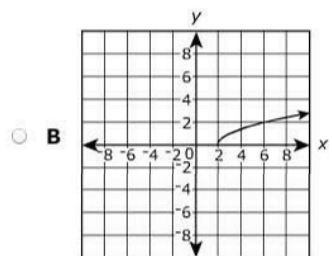
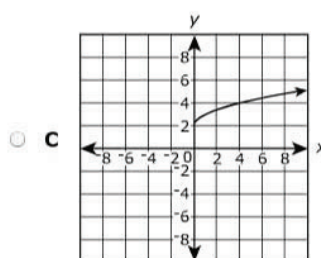
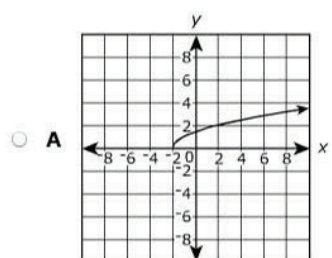
Which equation **best** represents the transformed graph?

- ☐ A $y = -|x + 4| - 3$
- ☐ B $y = |x + 4| + 3$
- ☐ C $y = -|x + 4| + 3$
- ☐ D $y = |x + 4| - 3$

Performance Indicator: 3103.3.10 Identify and/or graph a variety of functions and their transformations.

86.

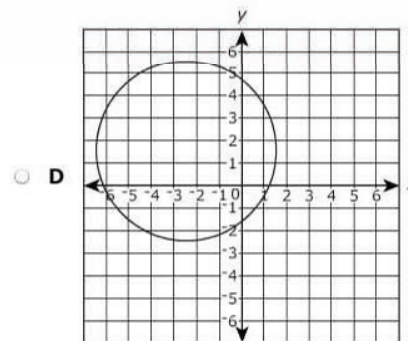
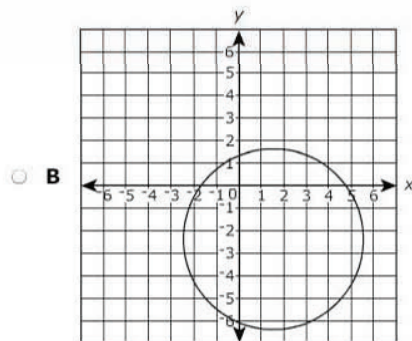
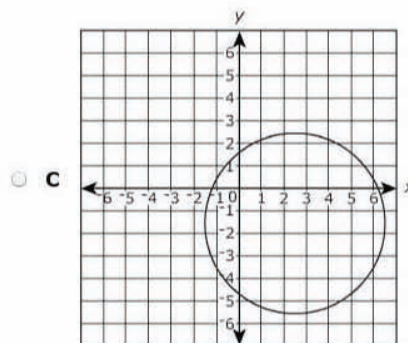
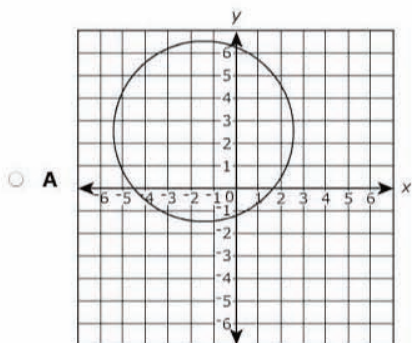
The function $f(x) = \sqrt{x}$ is transformed to become the function $g(x) = \sqrt{x - 2}$. Which graph **best** represents $g(x)$?



Performance Indicator: 3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.

87.

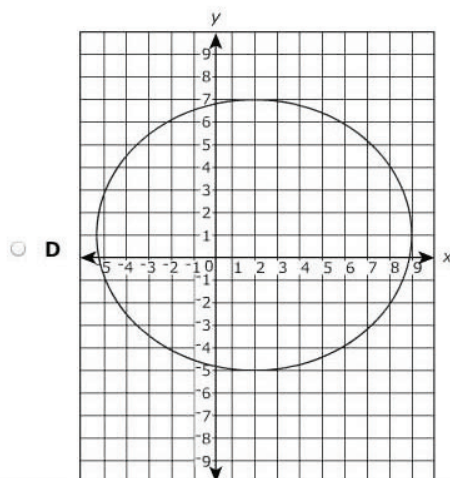
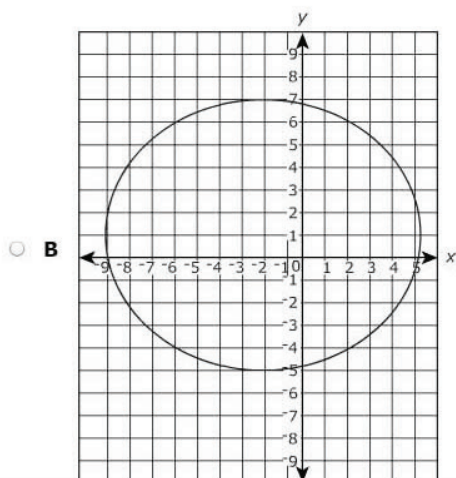
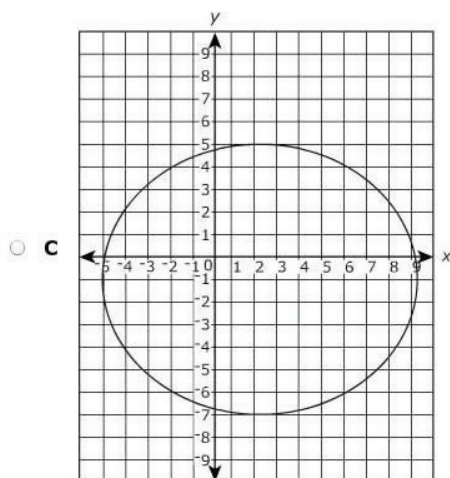
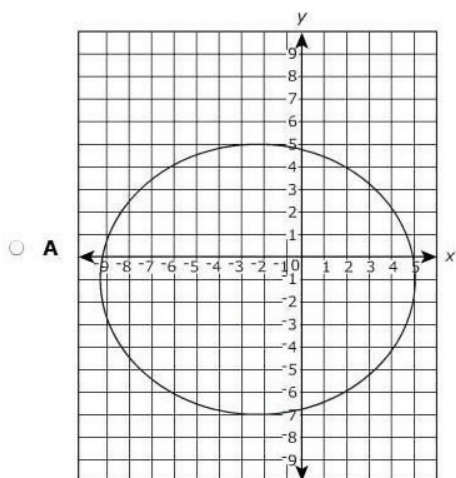
Which graph **best** represents $\left(x - \frac{5}{2}\right)^2 + \left(y + \frac{3}{2}\right)^2 = 16$?



Performance Indicator: 3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.

88.

Which graph best represents $\frac{(x+2)^2}{49} + \frac{(y-1)^2}{36} = 1$?



Performance Indicator: 3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.

89.

Which equation can be used to graph a hyperbola with foci $(0, \pm 3)$ and vertices $(0, \pm 2)$?

☐ A $\frac{y^2}{4} + \frac{x^2}{5} = 1$

☐ B $\frac{x^2}{4} - \frac{y^2}{5} = 1$

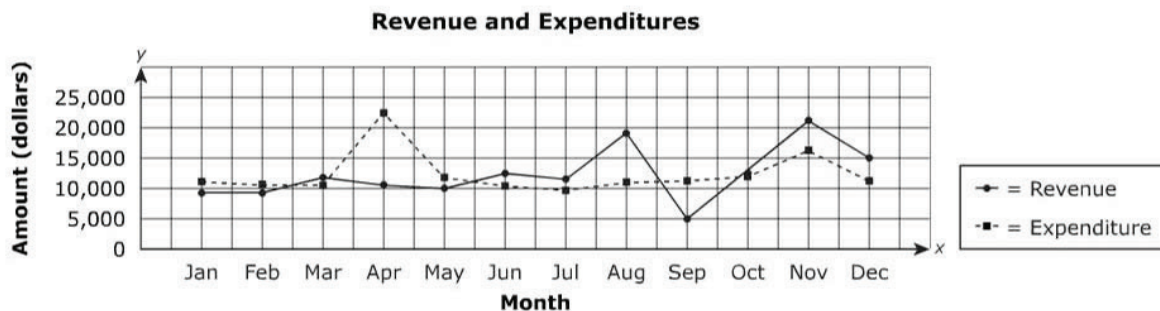
☐ C $\frac{y^2}{4} - \frac{x^2}{5} = 1$

☐ D $\frac{y^2}{\sqrt{5}} - \frac{x^2}{2} = 1$

Performance Indicator: 3103.3.12 Interpret graphs that depict real-world phenomena.

90.

The graph below shows the monthly revenue and expenditures of a company. The profit earned each month is the amount of revenue minus the amount of expenditure.



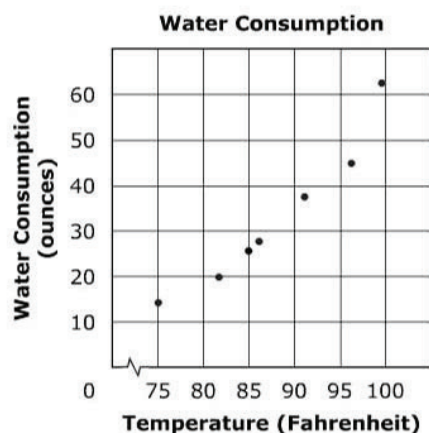
In which month does the company have the greatest profit?

- ☐ A March
- ☐ B April
- ☐ C August
- ☐ D November

Performance Indicator: 3103.3.12 Interpret graphs that depict real-world phenomena.

91.

The graph below shows the water consumed by an adult over a three-hour period daily for seven days chosen at random during the summer.



Which statement is **best** supported by the data in the graph?

- ☐ A The difference in water consumption at 75°F and 85°F was about 12 ounces.
- ☐ B The water consumption decreases as the temperature increases.
- ☐ C The difference in water consumption at 83°F and 92°F was about 9 ounces.
- ☐ D The water consumption increases as the temperature decreases.

Performance Indicator: 3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.

92.

The focal length, f , of a lens is described as the product of the distance between an object and the lens, u , and the distance between the image and the lens, v , divided by the sum of the two distances. An object placed at a distance of 8 centimeters (cm) from the lens produces an image 6 cm from the lens. Which measure is closest to the focal length of the lens?

- ☐ A 1.3 cm
- ☐ B 3.0 cm
- ☐ C 3.4 cm
- ☐ D 4.0 cm

Performance Indicator: 3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.

93.

In a factory, the number of sewing machines, N , assembled by a worker per day after d working days is modeled by $N = 10(1 - e^{-0.115d})$. Approximately how many sewing machines can a worker assemble after 14 working days?

- ☐ A 2
- ☐ B 8
- ☐ C 12
- ☐ D 40

Performance Indicator: 3103.3.14 Solve problems involving the binomial theorem and its connection to Pascal's Triangle, combinatorics, and probability.

94.

What is the coefficient of the sixth term in the expansion of $(3x - y^2)^{10}$?

- ☐ A -153,090
- ☐ B -61,236
- ☐ C 61,236
- ☐ D 153,090

Performance Indicator: 3103.3.14 Solve problems involving the binomial theorem and its connection to Pascal's Triangle, combinatorics, and probability.

95.

Dirk is packing his bags for a vacation. Of all his T-shirts, 30% are white. If he packs 8 T-shirts, what is the probability that exactly 3 of them are white?

- ☐ A $(0.30)^3(0.70)^5$
- ☐ B $(0.30)^3(0.70)^8$
- ☐ C $56(0.30)^5(0.70)^3$
- ☐ D $56(0.30)^3(0.70)^5$

Reporting Category 3: Algebra

Item Number	Correct Answer	Performance Indicator
1	D	3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.
2	A	3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.
3	C	3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.
4	B	3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.
5	B	3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.
6	C	3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.
7	D	3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.
8	D	3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.
9	B	3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.
10	A	3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.
11	D	3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.

12	C	3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.
13	C	3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.
14	A	3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.
15	C	3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.
16	B	3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.
17	C	3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.
18	A	3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.
19	C	3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.
20	D	3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.
21	C	3103.3.9 Graph the solution set of two or three linear or quadratic inequalities.
22	C	3103.3.9 Graph the solution set of two or three linear or quadratic inequalities.
23	B	3103.3.10 Identify and/or graph a variety of functions and their transformations.

24	B	3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.
25	A	3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.
26	A	3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.
27	B	3103.3.12 Interpret graphs that depict real-world phenomena.
28	D	3103.3.12 Interpret graphs that depict real-world phenomena.
29	A	3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.
30	D	3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.
31	A	3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.
32	D	3103.3.14 Solve problems involving the binomial theorem and its connection to Pascal's Triangle, combinatorics, and probability.
33	A	3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.
34	A	3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.
35	D	3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.

36	B	3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.
37	D	3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.
38	B	3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.
39	A	3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.
40	C	3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.
41	A	3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.
42	B	3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.
43	B	3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.
44	A	3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.
45	C	3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.
46	D	3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.
47	B	3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.

48	A	3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.
49	B	3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.
50	A	3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.
51	C	3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.
52	D	3103.3.8 Solve systems of three linear equations in three variables.
53	B	3103.3.9 Graph the solution set of two or three linear or quadratic inequalities.
54	C	3103.3.10 Identify and/or graph a variety of functions and their transformations.
55	D	3103.3.10 Identify and/or graph a variety of functions and their transformations.
56	A	3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.
57	D	3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.
58	A	3103.3.12 Interpret graphs that depict real-world phenomena.
59	A	3103.3.12 Interpret graphs that depict real-world phenomena.
60	C	3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.

61	A	3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.
62	B	3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.
63	D	3103.3.14 Solve problems involving the binomial theorem and its connection to Pascal's Triangle, combinatorics, and probability.
64	B	3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.
65	C	3103.3.1 Add, subtract, and multiply polynomials; divide a polynomial by a lower degree polynomial.
66	B	3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.
67	B	3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.
68	A	3103.3.2 Solve quadratic equations and systems, and determine roots of a higher order polynomial.
69	C	3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.
70	B	3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.
71	A	3103.3.3 Add, subtract, multiply, divide, and simplify rational expressions including those with rational and negative exponents.
72	D	3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.

73	C	3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.
74	C	3103.3.4 Use the formulas for the general term and summation of finite arithmetic and both finite and infinite geometric series.
75	D	3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.
76	A	3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.
77	D	3103.3.5 Describe the domain and range of functions and articulate restrictions imposed either by the operations or by the contextual situations which the functions represent.
78	C	3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.
79	B	3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.
80	C	3103.3.6 Combine functions (such as polynomial, rational, radical, and absolute value expressions) by addition, subtraction, multiplication, division, or by composition and evaluate at specified values of their variables.
81	B	3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.
82	A	3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.
83	A	3103.3.7 Identify whether a function has an inverse, whether two functions are inverses of each other, and/or explain why their graphs are reflections over the line $y = x$.

84	B	3103.3.9 Graph the solution set of two or three linear or quadratic inequalities.
85	A	3103.3.10 Identify and/or graph a variety of functions and their transformations.
86	B	3103.3.10 Identify and/or graph a variety of functions and their transformations.
87	C	3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.
88	B	3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.
89	C	3103.3.11 Graph conic sections (circles, parabolas, ellipses and hyperbolas) and understand the relationship between the standard form and the key characteristics of the graph.
90	C	3103.3.12 Interpret graphs that depict real-world phenomena.
91	A	3103.3.12 Interpret graphs that depict real-world phenomena.
92	C	3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.
93	B	3103.3.13 Solve contextual problems using quadratic, rational, radical and exponential equations, finite geometric series, or systems of equations.
94	B	3103.3.14 Solve problems involving the binomial theorem and its connection to Pascal's Triangle, combinatorics, and probability.
95	D	3103.3.14 Solve problems involving the binomial theorem and its connection to Pascal's Triangle, combinatorics, and probability.